PART 5. CHAPTER 3

RADIOLOGICAL HEALTH

SUBCHAPTER 1. RADIATION PROTECTION

Section:

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SUBCHAPTER 1. RADIATION PROTECTION

Section 5-301. Purpose, Authority, Effective Date.

~~The Board of Health finds that ionizing radiation and sources thereof relate to public health and the preservation of public health requires the promulgation of rules and regulations pertaining to such radiation and sources thereof.~~

~~This regulation establishes standards for protection against radiation hazards associated with sources of ionizing radiation.~~

~~Source. Regulation for Radiation Protection.~~
~~Effective. December 10, 1977.~~
~~Authority. 18 V.S.A. Sec. 102 and 18 V.S.A. Chapter 32.~~

Purpose: This rule establishes standards for the control of ionizing radiation for the protection of the occupational and public health and safety and implements the provisions of 18 V.S.A. Chapter 32. This rule regulates x-ray and other radiographic

diagnostic equipment used by physicians, dentists and other health professionals, occupational sources of radiation, and the radiation levels at the site-boundary of the Vermont Yankee Nuclear Power Station.

This rule sets maximum limits in terms of the dose an individual may receive depending on the source and type of ionizing radiation. For people who work with radioactive materials or equipment, or members of the general public, the dose the individual receives is the unit of measure for the purposes of protection of the public health. Because people do not absorb all the radiation to which they are exposed, a dose conversion factor is necessary to determine the dose equivalent an individual would receive from the source of the radiation. The rule sets the dose conversion factor for purposes of converting the level of measured exposure of radiation to the dose limits for purposes of determining compliance with the requirements of the rule.

Authority: This rule is adopted under the authority of 3 V.S.A. §§ 801(b)(11) and 3003(a) and 18 V.S.A. § 1652(c).

Effective Date: All provisions of this rule shall be effective on July 1, 2009.

Section 5-302. Scope.

This rule ~~regulation~~ applies to all persons who receive, possess, use or transfer sources of ionizing radiation except that nothing in these regulations shall be construed to limit the kind or amount of radiation that may be applied intentionally to a patient for diagnostic or therapeutic purposes by or under the direction of a practitioner of the healing arts licensed by the State of Vermont. ~~as follows:~~

~~A person licensed to practice chiropody.~~
~~A person licensed to practice chiropractic.~~
~~A person licensed to practice dentistry.~~
~~A person licensed to practice medicine and surgery.~~
~~A person licensed to practice osteopathy.~~

Section 5-303. Definitions.

(1) "Absorbed dose" means the energy imparted by ionizing radiation per unit of mass of irradiated material. The units of absorbed dose are the rad and the gray (Gy).

~~(A)~~(2) "As low as is reasonably achievable"~~,~~(ALARA) means making every reasonable effort to maintain exposures to radiation as far below the dose limit in this rule as is practical consistent with the purpose for which the regulated activity is undertaken, ~~for the purpose of this regulation means as low as is reasonably achievable~~ taking into account the state of technology, ~~at or available to Vermont Yankee~~ and the economics of improvements in relation to the benefits to the

public health and safety, and other societal and socioeconomic considerations, and in relation to ~~the~~ utilization of nuclear ~~or atomic~~ energy and regulated materials in the public interest.

~~(B)~~(3) "Background radiation"~~, for the purposes of this regulation,~~ means radiation from cosmic sources, ~~the~~ naturally occurring radioactive~~ity~~ material, including radon (except as a decay product of source or special nuclear material); and global fallout as it exists in the environment from the testing of nuclear explosive devices or from past nuclear accidents such as Chernobyl that contribute to background radiation and are not under the control of the regulated entity. "Background radiation" does not include radiation from source, byproduct, or special nuclear materials regulated by this rule~~of the atmosphere that results from the presence of radioactive materials which originate either from radioactive minerals in the earth's crust or from the interaction of cosmic radiation with the gases of the atmosphere. It also includes the radioactivity contributed by atmospheric nuclear weapons testing programs~~.

(4) "Bioassay" (radiobioassay) means the determination of kinds, quantities or concentrations, and, in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo counting) or by analysis and evaluation of materials excreted or removed from the human body.

~~(C)~~(5) "Board" means the Vermont Board of Health.

(6) "Commissioner" means the Commissioner of the Vermont Department of Health, or designee.

(7) "Committed dose equivalent ($H_{T.50}$) means the dose equivalent to organs or tissues of reference (T) that will be received from an intake of radioactive material by an individual during the 50-year period following intake.

(8) "Committed effective dose equivalent ($H_{E.50}$) is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed does equivalent to these organs or tissues ($H_{E.50} = \Sigma W_T H_{T.50}$).

(9) "Controlled area" means an area, outside of a restricted area but inside the site boundary, access to which can be limited by the *regulated entity* for any reason.

~~(D)~~(10) "Curie" (Ci) is defined as 3.7×10^{10} disintegrations per second. Commonly used submultiples of the c~~C~~urie are millic~~C~~urie (mCi) and the microc~~C~~urie (µCi):

1. One millic~~C~~urie = 0.001 c~~C~~urie
2. One microc~~C~~urie = 0.000001 c~~C~~urie

(11) “Declared pregnant woman” means a woman who has voluntarily informed the regulated entity, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

(12) “Department” means the Vermont Department of Health.

~~(E)“Dose” means the quantity of radiation absorbed, per unit of mass, by the body or any portion of the body.~~

(13) “Dose equivalent” (H_T) means the product of the absorbed dose in tissue, quality factor, and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert (Sv).

(14) “Effective dose equivalent” (H_E) is the sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated ($H_E = \Sigma W_T H_T$).

(15) “Embryo/fetus” means the developing human organism from conception until the time of birth.

(16) “Exposure” means being exposed to ionizing radiation or to radioactive material.

(17) “External dose” means that portion of the dose equivalent received from radiation sources outside the body.

(18) “Gray”(Gy) is the SI unit of absorbed dose. One gray is equal to an absorbed dose of 1 Joule/kilogram (100 rads).

~~(F)~~(19) “Individual” means any human being.

(20) “Individual monitoring” means— (1) The assessment of dose equivalent by the use of devices designed to be worn by an individual; (2) The assessment of committed effective dose equivalent by bioassay or by determination of the time-weighted air concentrations to which an individual has been exposed, i.e., DAC-hours; or (3) The assessment of dose equivalent by the use of survey data.

(21) “Licensee” means the holder of a license issued by the NRC.

(22) “Limits” (dose limits) means the permissible upper bounds of radiation doses.

(23) “Member of the public” means any individual except when that individual is receiving an occupational dose.

(24) “Minor” means an individual less than 18 years of age.

(25) “Monitoring” (radiation monitoring, radiation protection monitoring) means the measurement of radiation levels, concentrations, surface area concentrations or quantities of radioactive material and the use of the results of these measurements to evaluate potential exposures and doses.

(26) “NRC” means the Nuclear Regulatory Commission or its duly authorized representatives.

(27) “Occupational dose” means the dose received by an individual in the course of employment in which the individual’s assigned duties involve exposure to radiation or to radioactive material from regulated and unregulated sources of radiation, whether in the possession of the regulated entity or other person. Occupational dose does not include doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released, from voluntary participation in medical research programs, or as a member of the public.

(28) “Public dose” means the dose received by a member of the public from exposure to radiation or to radioactive material released by a regulated entity, or to any other source of radiation under the control of a regulated entity. Public dose does not include occupational dose or doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released, or from voluntary participation in medical research programs.

(29) “Quarter” means a period of time equal to one-fourth of the year observed by the regulated entity (approximately 13 consecutive weeks), providing that the beginning of the first quarter in a year coincides with the starting date of the year and that no day is omitted or duplicated in consecutive quarters.

(30) “Rad” is the special unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/gram or 0.01 joule/kilogram (0.01 gray).

(31) “Radiation” (ionizing radiation) means alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in this part, does not include non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light.

~~(G)“Unrestricted Area” means any area, access to which is not controlled by the owner or person having possession of any source of ionizing radiation, for purposes of protection of individuals from exposure to radiation and radioactive materials, or to any area used for residential quarters.~~

~~(H)"Ionizing radiation" means gamma rays and X-rays, alpha and beta particles, high speed electrons, neutrons, protons and other nuclear particles, but not sound or radio waves or visible, infrared, or ultraviolet light.~~

~~(I)~~(32) "Radioactive materials' means all materials that are determined to be a source of ionizing radiation.

~~(J)"Radioactive materials' (radioactivity) is commonly, and for purposes of this regulation, is measured in terms of disintegrations per unit time or in Curies.~~

(33) "Registrant" means a person registered with the Department pursuant to this rule.

~~(K)~~(34) "Rem" ~~means a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of one Roentgen (R) of X-rays. A commonly used submultiple of the rem is the millirem (mrem):~~

~~1.One millirem (mrem) = 0.001 rem~~

~~For the purpose of this regulation any of the following is considered to be equivalent to a dose of one rem:~~

~~1.A dose of 1 R due to X- or gamma radiation.~~
~~2.A dose of 1 rad due to X-, gamma or beta radiation.~~
~~3.A dose of 0.1 rad due to neutrons or high energy protons.~~
~~4.~~1. ~~A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye.~~

is the special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem=0.01 sievert).

As used in this rule, the quality factors for converting absorbed dose to dose equivalent are shown in Table 1.

TABLE 1—Quality Factors and Absorbed Dose Equivalencies

Type of radiation	Quality Factor (Q)	Absorbed dose equal to a unit dose equivalent[a]
X-, gamma, or beta radiation	1	1

Alpha particles, multiple-charged particles, fission fragments and heavy particles of unknown charge	20	0.05
Neutrons of unknown energy	10	0.1
High-energy protons	10	0.1

[a] Absorbed dose in rad equal to 1 rem or the absorbed dose in gray equal to 1 sievert.

(35) "Sanitary sewerage" means a system of public sewers for carrying off waste water and refuse, but excluding sewage treatment facilities, septic tanks, and leach fields owned or operated by the regulated entity.

(36) "Sievert" is the SI unit of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv=100 rems).

(37) "Site boundary" means that line beyond which the land or property is not owned, leased, or otherwise controlled by the regulated entity.

(38) "Survey" means an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation, or concentrations or quantities of radioactive material present.

(39) "Total Effective Dose Equivalent" (TEDE) means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures).

40)"Unrestricted Area means an area, access to which is neither limited nor controlled by the regulated entity.

(41) "VYNPS" means the Vermont Nuclear Power Station, the entity licensed by the NRC to operate the plant and its owners.

(42) "Weighting factor" W_T, for an organ or tissue (T) is the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly. For calculating the effective dose equivalent, the values of W_T are:

ORGAN DOSE WEIGHTING FACTORS

Organ or tissue	W_T
Gonads	0.25
Breast	0.15
Red bone marrow	0.12
Lung	0.12
Thyroid	0.03
Bone surfaces	0.03
Remainder	0.30[1]
Whole Body	1.00[2]

[1] 0.30 results from 0.06 for each of 5 ''remainder'' organs (excluding the skin and the lens of the eye) that receive the highest doses.

[2] For the purpose of weighting the external whole body dose (for adding it to the internal dose), a single weighting factor, W_T =1.0, has been specified. The use of other weighting factors for external exposure will be approved on a case-by-case basis until such time as specific guidance is issued.

(43)"Whole body" means, for purposes of external exposure, head, trunk (including male gonads), arms above the elbow, or legs above the knee.

(44) "Year" means the period of time beginning in January used to determine compliance with the provisions of this part. The regulated entity may change the starting date of the year used to determine compliance by the regulated entity provided that the change is made at the beginning of the year and that no day is omitted or duplicated in consecutive years.

Section 5-304. Exemptions.

The following materials, machines and conditions are exempt from these regulations:

(A) Radioactive materials of an equivalent specific radioactivity not exceeding that of natural potassium. (10^{-9} c~~C~~uries per gram of potassium).

(B) ~~(1)~~ Quantities of byproduct, source, accelerator produced, and special nuclear materials exempted from licensing requirements of the U.S. Nuclear Regulatory Commission as defined in Code of Federal Regulations, Title 10~~, Parts 30.15, 30.16, 30.18 and 30.71~~.

~~(2) Sealed sources of radium of one microCurie or less, and unsealed sources of radium of 0.1 microCurie or less, providing the user does not possess more than 10 such quantities.~~

~~(3) Quantities of source material for which the U.S. Nuclear Regulatory Commission has issued a general license in Code of Federal Regulations, Title 101, Part 40.22.~~

~~(4)Quantities of accelerator produced radionuclides not exceeding the quantities listed in Code of Federal Regulations, Title 10, Part 30.71 or for nuclides not listed therein, not exceeding 10 microCuries.~~

(C) Domestic television receivers, providing the effective dose rate at 5 cm from any outer surface is less than 0.5 mrem per hour.

(D) Other electrical equipment that produces radiation incidental to its operation for other purposes, providing the effective dose rate to the whole body at the point of nearest approach to such equipment when any external shielding is removed does not exceed 0.5 rem per year. The production testing or factory servicing of such equipment shall not be exempt.

(E) Radiation machines which cannot be used in such manner as to produce radiation. (For example, X-ray machines in transport or electrical equipment in storage).

(F) Radioactive material, except as specified in Section 5-311, being transported across the state in conformance with regulations of any Federal agency having jurisdiction over safety in interstate commerce.

(G) Excreta from individuals undergoing medical diagnosis or therapy with radioactive materials are exempt from any limitation contained in this regulation.

(H) Other sources of radiation that the Department~~agency~~ finds should be exempted.

Section 5-305. Standards.

(A) The ~~Division of Occupational Health, Vermont~~ Department ~~of Health~~ shall make use of the best scientific information, recommendations and guidelines such as those contained in ~~the recommendations contained in~~ the reports and other publications of the National Council on Radiation Protection and Measurements, ~~and the handbooks of the National Bureau of Standards~~ the National Institute of Standards and Technology, the Health Physics Society, the International Commission on Radiological Protection, the American Nuclear Society, the Food and Drug Administration, the Environmental Protection Agency, the Nuclear

Regulatory Commission, the Conference of Radiation Control Program Directors and the American National Standards Institute, as applicable, in the interpretation and implementation of this rule~~as standards and bases for calculations to obtain and maintain safe conditions within the meaning of the regulation~~.

(B) Maximum Permissible Total Effective Dose Equivalent

(1) Except activities regulated by subsection 5-305(D) for VYNPS, the maximum permissible total effective dose equivalent of individuals from all regulated uses of ionizing radiation shall be kept as low as reasonably achievable (ALARA) and shall not exceed the levels specified below:

a) 0.5 rem for the fetus during the entire gestation period from occupational radiation exposure of a declared pregnant woman.

b) 0.1 rem per year for minors under 18 years of age from occupational radiation exposure or from radiation exposure received during educational or training activities.

c) 0.1 rem per year for members of the public from any source of ionizing radiation.

d) 5.0 rem per year from occupational radiation exposure for all other individuals not covered by subsections (a), (b) or (c).

(2) Dose conversion factors for radiation sources for purposes of determining compliance with the limits established in this section are determined on a case-by-case basis accounting for differences in radiation type, radiation energy, the exposure geometry, the environmental conditions and the characteristics of the exposed person.

(C) Additional Criteria for the Healing Arts

(1) Practices of the regulated entity shall be consistent with those recommended by the National Council for Radiation Protection and other guidance bodies as cited in Section 5-305(A).

~~(1)~~(2)~~(a)~~ Entrance Skin Exposure Criteria (ESEC) for non-specialty radiographic examinations shall not be exceeded when technical factors for an average adult patient (Standard person—defined below) are utilized.

~~1)~~(a) P.A. Chest: ESEC shall not exceed 30 milli~~R~~r~~oentgens~~ per radiograph. Radiation exposure at the patient's skin of 15 milli~~R~~r~~oentgens~~ or less per radiograph is strongly recommended.

~~2.~~(b) Lateral Skull: ESEC shall not exceed 300 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 200 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~3.~~(c) A.P. Abdomen: ESEC shall not exceed 750 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 500 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~4.~~(d) A.P. Cervical Spine: ESEC shall not exceed 250 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 175 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~5.~~(e) A.P. Thoracic Spine: ESEC shall not exceed 900 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 600 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~6.~~(f) A.P. Lumbar Spine: ESEC shall not exceed 1000 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 675 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~7.~~(g) A.P. Retrograde Pyelogram: ESEC shall not exceed 900 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 600 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~8.~~(h) Dental (Bitewing or Periapical): ESEC shall not exceed 700 millir~~R~~oentgen~~s~~ per radiograph. Radiation exposure at the patient's skin of 350 millir~~R~~oentgen~~s~~ or less per radiograph is strongly recommended.

~~(b)~~(3) A standard person, for purposes of this regulation, is defined as an individual meeting the following anthropometric guidelines for the radiographic examination projection specified.

Body Part Description	Thickness of Part	Examination
Thorax	23 centimeters	P.A. chest
Head	15	Lateral Skull
Abdomen	23	A.P. Abdomen

Neck	13	A.P. Cervical Spine
Thorax	23	A.P. Thoracic Spine
Abdomen	23	A.P. Lumbar Spine
Abdomen	23	A.P. Retrograde Pyelogram

~~(c)~~(4) Actual patient skin doses may exceed those shown for the standard person or for correlated doses for persons of greater or lesser anthopometric measurements if the attending practitioner of the healing arts determines that clear and present medical/dental necessity requires such dosage increase. A written, signed statement by the practitioner explaining the need for increased patient dosage shall become a permanent part of the patient's medical/dental record.

ADVISORY NOTE: The following Entrance Skin Exposure Criteria measurement protocol will be used by the State Health Department personnel to obtain data for regulatory purposes:

~~1)~~(a) A calibrated integrating radiation measuring device is placed in the center of the primary X-ray field at the location of entrance skin of a standard person for determination of exposure in air.

~~2)~~(b) Technical factors and other parameters such as field size and source-to-receptor distance are determined for a specific examination of a standard person.

~~3)~~(c) For photo-timed X-ray equipment, a phantom designed to simulate attenuation of a standard person is placed between the radiation measuring device and the photo-time sensing element in a manner to minimize backscatter.

~~4)~~(d) The radiographic equipment is energized (without patient) and the radiation measuring device reading is recorded for compliance purposes.

~~(2)~~(5) ~~(a)~~ Specific area gonad shielding on patients during medical diagnostic X-ray procedures shall have a lead equivalent of at least 0.25 mm and shall be required when the following conditions exist:

~~1)~~(a) The gonads will lie within the primary X-ray field or within close proximity (5 centimeters) despite proper beam limitation.

ADVISORY NOTE: Specific area testicular shielding also should be used during examinations of the abdominal region in which the testes may lie close to the primary X-ray field. Examples of such examinations include lumbar spine, intravenous pyelogram, and abdomen films.

~~2.~~(b) The clinical objectives of the examination will not be compromised.

ADVISORY NOTE: Each X-ray facility should compile a list of radiographic examinations for which gonad shielding is appropriate. Specific area ovarian shielding should be used during any examination of the abdominal region when such shielding will not obscure visualization of adjacent structures required by the examination. Specific area testicular shielding should be used for all examinations of male patients in which the pubic symphysis will be visualized on the film and when such shielding will not obscure visualization of adjacent structures required by the examination.

~~3.~~(c) The patient has a reasonable reproductive potential.

~~(3)~~(6) Special dose limiting requirements.

~~(a)~~Protection of the embryo or fetus during radiological examination of women known to be pregnant shall be given special consideration.

ADVISORY NOTE: It is recommended that radiologic examinations of the abdomen and pelvis which do not contribute to the diagnosis of pregnant or potentially pregnant women in relation to their current illness be restricted to the first 10 days of the menstrual cycle in the case of potentially pregnant individuals and avoided entirely during known pregnancy. The attending practitioner of the healing arts retains full and complete discretion to carry out any radiographic examination considered medically necessary without regard for the phase of the menstrual cycle or fetal presence.

~~(b)During the entire gestation period, the maximum permissible dose equivalent to the fetus from occupational radiation exposure of the expectant mother shall not exceed 0.5 rem.~~

~~ADVISORY NOTE: Annual dose accumulation should be kept below 2 or 3 rems acquired at a more or less steady rate. In such cases, the probability of the dose to a fetus exceeding 0.5 rem before a pregnancy is recognized is small.~~

~~(c)Maximum Permissible Dose Equivalent for minors under 18 years of age shall not exceed 0.1 rem per year from occupational radiation exposure or from radiation exposure received during educational or training activities. This is to be considered to be a part of the annual dose limit of 0.5 rem appropriate for an individual in the general public, and not supplemental to it.~~

(D) Criteria Applicable to VYNPS Relating to Members of the Public

~~Notwithstanding part (A) of this section, e~~Exposure of members of the public ~~individuals~~ in unrestricted areas to radiation and radioactive materials from the V~~ermont~~ Y~~ankee~~ N~~uclear~~ P~~ower~~ S~~tation~~ shall be kept as low as is reasonably achievable.

(1) Discharges of radioactive materials and direct gamma radiation to unrestricted areas shall be controlled as follows:

(a) Gaseous Effluents

~~1)~~ The annual committed effective dose equivalent limit~~objective~~ for ~~the total body of~~ an individual in an unrestricted area due to plant emissions of radioactive noble gases is 5 millirem~~s~~. ~~For the purpose of this objective an annual average release rate of 1 percent of the maximum allowable release rate as defined in (B)(1)(a) 2) will be considered equivalent to a dose of 5 millirems per year.~~

~~2) The maximum release rate of any mixture of radioactive noble gases from the plant shall not exceed 0.08/Ēγ Ci/sec, where Ēγ is the average gamma decay energy for the gaseous effluent mixture in MeV/disintegration.~~

~~3) If a routine surveillance check as described in Vermont Yankee Technical Specifications reveals that the maximum release rate limit of Section 5-305 (B)(1)(a) 2) has been exceeded, an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours.~~

~~4) If the release rate of any mixture of radioactive noble gases, averaged over a calendar quarter, exceeds 4 percent of the limit defined in (B)(1)(a) 2) the actions described in (B)(2) shall be taken.~~

~~5) If the release rate of any mixture of radioactive noble gases, averaged over a calendar quarter, exceeds 8 percent of the limit defined in (B) (1)(a) 2) the actions described in (B)(3) shall be taken.~~

(b) Liquid Effluents

~~1)~~ The annual committed effective dose equivalent limit ~~objective~~ for ~~the total body or any organ of~~ an individual in an unrestricted area, due to plant discharges of liquid effluents is 5 millirem~~s~~. ~~For the purpose of this objective an annual release of 1 percent of the maximum allowable concentrations as defined in (B)(1)(a) 2) through 4) will be considered equivalent to a dose of 5 millirems per year.~~

~~2) The maximum concentration of radioactive material, except tritium and dissolved noble gases, at the point of discharge to the Connecticut River shall not exceed 1 x 10^{-7} µCi/ml unless the discharge is controlled on a radionuclide basis in accordance with Appendix B, Table II, Column 2 of 10 CFR 20 and notes 1 – 5 thereto.~~

~~3) The maximum concentration of tritium at the point of discharge to the Connecticut River shall not exceed 3 x 10^{-3} µCi/ml.~~

~~4) The maximum concentration of dissolved noble gases at the point of discharge to the Connecticut River shall not exceed 4 x 10^{-5} µCi/ml.~~

~~5) If the limits defined in Section 5-305 (B)(1)(b) 2) through 4) cannot be met, radioactive liquid effluents shall not be released.~~

~~6) If the concentrations of radioactive materials in liquid effluents, when averaged over a calendar quarter, except tritium and dissolved noble gases, exceeds 2 percent of the limits defined in (B)(1)(b) 2) the actions described in (B)(2) shall be taken.~~

~~7) If the average concentration of tritium exceeds 6 x 10^{-5} µCi/ml or the average concentration of dissolved noble gases exceeds 8 x 10^{-7} µCi/ml during a calendar quarter, the actions described in Section 5-305 (B)(2) shall be taken.~~

~~8) If the concentrations of radioactive materials in liquid effluents, when averaged over a calendar quarter, except tritium and dissolved noble gases, exceeds 4 percent of the limits defined in (B)(1)(b) 2) the actions described in (B)(3) shall be taken.~~

~~9) If the annual average concentration of radioactive materials released during a calendar quarter exceeds 1 x 10^{-4} µCi/ml for tritium or 2 x 10^{-6} µCi/ml for dissolved noble gases, the actions described in (B)(3) shall be taken.~~

(c) Radioiodine

~~1)~~ The annual committed effective dose equivalent limit~~objective for the thyroid~~ of an individual in an unrestricted area due to plant emissions of radioiodine is 5 millirem~~s~~. ~~For the purpose of this objective, the release rate of radioiodine-131 shall be determined from the sum of analyses of the stack charcoal cartridge and the stack particulate filter for iodine-131. Furthermore, an annual average release~~

~~rate of 1 percent of the maximum release rate as defined in (B)(1)(c) 2) will be considered equivalent to a thyroid dose of 5 millirems, based on the above analyses.~~

~~2) The maximum release rate of iodine-131 from the plant shall not exceed 0.57 µCi/sec.~~

~~3) If a routine surveillance check as described in Vermont Yankee Technical Specifications reveals that the maximum release rate limit of Section 5-305 (B)(1)(c) 2) has been exceeded, an orderly shutdown shall be initiated and the reactor shall be in the cold shutdown condition within 24 hours.~~

~~4) If the release rate of iodine-131, averaged over a calendar quarter, exceeds 2 percent of the limit defined in (B)(1)(c) 2), the actions described in (B)(2) shall be taken.~~

~~5) If the release rate of iodine-131, averaged over a calendar quarter, exceeds 4 percent of the limit defined in (B)(1)(c) 2) the actions described in (B)(3) shall be taken.~~

(d) Radioactive Particulates

~~1)~~ The annual committed effective dose equivalent limit~~objective~~ for ~~any organ of~~ an individual in an unrestricted area due to plant emissions of radioactive particulates is 5 millirem~~s~~. ~~For the purpose of this objective, an annual average release rate of 1 percent of the maximum release rate as defined in Section 5-305 (B)(1)(d) 2) will be considered equivalent to a dose of 5 millirems per year.~~

~~2) The maximum release rate of radioactive particulates with half lives greater than 8.1 days, shall not exceed 1.6 x 10^3 MPCa Ci/sec where MPCa is the composite maximum permissible concentration in air as determined in Appendix B, Table II, Column I of 10 CFR, Part 20 and notes 1 – 5 thereto.~~

~~3) If a routine surveillance check, as described in Vermont Yankee Technical Specifications, reveals that the maximum release rate limit of Section 5-305 (B)(1)(d) 2) has been exceeded, an orderly shutdown shall be initiated and the reactor shall be in cold shutdown condition within 24 hours.~~

~~4) If the release rate of radioactive particulates with half lives greater than 8.1 days, averaged over a calendar quarter, exceeds 2 percent of the limits specified in Section 5-305 (B)(1)(d) 2) the actions described in (B)(2) shall be taken.~~

~~5) If the release rate of radioactive particulates with half lives greater than 8.1 days, averaged over a calendar quarter, exceeds 8 percent of the limits defined in Section 5-3-5 (B)(1)(d) 2), the actions described in (B)(3) shall be taken.~~

(e) Direct Gamma Radiation

1) The annual effective dose equivalent limitobjective for a member of the publicthe total body of an individual in an unrestricted area due to plant emanations of gamma radiation is 5 millirems. For the purpose of this subsectionobjective, a calculated effective dose equivalent of 20 millirems per year at any point on the site boundary bordered by land shall be considered equivalent to a 5 millirem effective dose equivalent at the nearest residences in Vermont.

2) If any site boundary, bordered by land, quarterly average dose exceeds 10 millirems above background radiation, VYNPS shall take the actions described in subsection (BD)(23) shall be taken.

3) If any site boundary, bordered by land, quarterly average dose exceeds 20 millirems above background radiation, the actions described in (B)(3) shall be taken.

(2) If the radioactive materials discharged from Vermont Yankee exceed the rates, concentrations or quantities as defined in Subsections (B)(1)(a) 4), (B)(1)(b) 6), (B)(1)(b) 7), (B)(1)(c) 4), (B)(1)(d) 4), or (B)(1)(e) 2) of Section 5 305 of these regulations, Vermont Yankee management shall, as soon as it is evident that the quarterly average of any discharge will exceed these levels:

(a)Make an investigation to identify the causes of such release rates or radiation levels.

(b)Define and initiate a program to reduce such releases to within the objectives defined in (B)(1)(a) 1), (B)(1)(b) 1), (B)(1)(c) 1), (B)(1)(d) 1) and (B)(1)(e) 1).

(c)Report these actions to the State of Vermont Board of Health within 14 days of the date it became evident that the levels listed in (B)(2) would be exceeded, but in no event later than 10 days after the end of the calendar quarter; the report shall include submission of the plan for corrective action, to be approved by the Board of Health.

(d)Implement the approved plan with all reasonable speed.

(2) Compliance with Dose Limits for Members of the Public

(a) VYNPS shall submit an annual report to the Department detailing the surveys and calculations of discharges of all radioactive materials and direct gamma radiation from all operations and activities at the plant and

specifically addressing each of the applicable criteria specified in this rule. The annual report shall be due no later than April 15 for the prior calendar year.

(b) VYNPS shall submit monthly reports to the Department detailing the surveys and calculations of direct gamma radiation from all operations and activities at the plant and specifically addressing the quarterly and annual direct gamma radiation effective dose equivalent limits specified in this rule. The monthly reports shall include copies of all records of calibration of the main steam line radiation monitors and all other instruments used to monitor public doses and all reports relevant to the off-site dose calculation manual issued or created during the report period. The monthly reports shall be due no later than the 10th of the month for the prior calendar month.

(c) For purposes of the annual and monthly reports:

1) VYNPS shall calculate the committed effective dose equivalent of discharges of radioactive materials and the effective dose equivalent of direct gamma radiation to unrestricted areas as provided in the most current VYNPS Off-Site Dose Calculation Manual as approved by the Department; and

2) The Off-Site Dose Calculation Manual shall include a dose conversion factor of 0.60, except that the Department may approve a different dose conversion factor if:

a) VYNPS requests approval of a different dose conversion factor as part of an amendment to its Off-Site Dose Calculation Manual; and

b) The proposed dose conversion factor produces more accurate results for determining compliance with the limits established in this rule; and

c) The dose conversion factor is greater than or equal to 0.60; and

(d) VYNPS shall provide any other information requested by the Department relating to the information and underlying data and calculations in the annual and monthly reports.

(3) ~~If the radioactive materials discharged from Vermont Yankee exceed the rates, concentrations, or quantities defined in Subsections (B)(1)(a) 5), (B)(1)(b) 8), (B)(1)(b) 9), (B)(1)(c) 5), (B)(1)(d) 5), or (B)(1)(e) 3) of Section 5-305 of these regulations, Vermont Yankee~~ VYNPS shall take the following actions as soon as it becomes evident that the quarterly average or annual dose equivalents exceed,

or may exceed, the limits specified in this rule~~of discharges will exceed these levels~~, but in no event later than the last day of the calendar quarter in which the average discharge exceeds these levels.

(a) Immediately report the discharge or direct gamma radiation exceedance to the Department.

(b) Immediately m~~M~~ake an investigation to identify the causes of the exceedance, or anticipated exceedance, or maximum dose equivalent limits, including an evaluation of all discharges of radioactice materials or direct gamma radiation that contributed to the exceedance~~discharge which exceeded the levels listed in (B)(3) above~~, and initiate a program designed to insure that future discharges will be maintained at or below ~~the~~ levels not likely to cause exceedance of the dose equivalent limits specified in this rule ~~listed in (B)(2) above~~. As soon as possible, VYNPS shall report to the Department the action taken or proposed to be taken to achieve immediate reduction of the discharges for the Department's approval; and

~~Immediately report the quarterly average discharge rates to the Vermont Board of Health, together with the action taken or proposed to be taken to achieve immediate reduction of the discharges.~~

(c)VYNPS shall implement the plan approved by the Department with all reasonable speed.

~~(c)~~(d) Within 14 days, but in no event later than 10 days after the end of the calendar quarter, submit a report to the Department detailing the actions described ~~in (B)(3)(a)~~ above ~~to the Vermont Board of Health for the Board's approval~~ and providing verification of the completion of the implementation of the plan approved by the Department.

(4) Independent Compliance Monitoring by the Department

(a) The Department will conduct environmental surveys and sampling of discharges of radioactive materials and direct gamma radiation emanations and use that information to verify the reports filed by Vermont Yankee are consistent with the Department's findings.

(b) The Department shall evaluate the VYNPS surveys and calculations for consistency with the Department's independent surveys and calculations on a monthly, quarterly and annual basis. For purposes of determining consistency, the Department shall determine in January of each year the mean values to be used to evaluate the VYNPS reported

surveys and calculations for the upcoming calendar year. These mean values shall be based on a minimum period of no less than the prior 24 months and shall be:

1) the mean values of monthly, quarterly and annual surveys and calculations to demonstrate regulatory compliance as reported by VYNPS;

2) the mean values of monthly, quarterly and annual surveys and calculations to verify regulatory compliance from the Department's independent environmental surveys and sampling; and

3) the ratio of those two measures for each limit as established in Section 5-305(D)(1) of this rule.

(c) Consistency shall be established if the comparison demonstrates that the surveys and calculations on all three measures analyzed are within two standard deviations.

1) If the comparison demonstrates that the VYNPS surveys and calculations are consistent with the Department's independent monitoring surveys and calculations, then the VYNPS surveys and calculations shall be used to determine compliance with the limits established in this rule.

2) If the comparison does not demonstrate that the VYNPS surveys and calculations are consistent with the Departments independent monitoring surveys and calculations, then the Department shall institute appropriate action pursuant to Section 5-307 of this rule.

~~(C) Persons within the scope of this regulation, other than as described in Section 5-305 (A) and (B), shall control all sources of radiation by using the applicable recommendations contained in the reports of the National Council on Radiation Protection and Measurements and the National Bureau of Standards handbooks as standards and bases for calculations~~

Section 5-306. Inspections.

(A) All regulated entities~~persons~~ who receive, possess, use or transfer sources of ionizing radiation shall:

(1) Provide the Commissioner~~Director of the Occupational Health Division, or his authorized representative,~~ with copies of all reports

furnished the ~~U.S. N~~uclear ~~R~~egulatory ~~C~~ommission related to radioactive effluent~~s~~ discharge~~s~~d and gamma radiation emanations under normal or abnormal operating conditions.

(2) Permit the Commissioner~~Director of the Occupational Health Division, or his authorized representative,~~ at all times the opportunity to inspect and evaluate sources of radiation and the premises and facilities wherein such sources of radiation are used or stored, and shall make available pertinent data, as well as records and reports as may be required.

(3) Grant to the Commissioner~~Director of the Occupational Health Division, or his authorized representative,~~ access to all records pertaining to the radiological health and safety of employees, to discharges of radioactive material and gamma radiation emanations to the environment, and to any effect of the operation of the facility upon the environment.

(4) Provide the same notice to the Commisssioner~~Notify the Director of the Occupational Health Division, or his authorized representative,~~ of any radiological incident and reports thereof and in the same manner as provided to the NRC~~as defined and referred to in 10 CFR 20.403 and 20.405~~.

(5) Permit the Commissioner~~Director of the Occupational Health Division, or his authorized representative,~~ to make unscheduled visits to the regulated facility~~plant~~ for the purpose of obtaining samples and surveys ~~of liquid or gaseous effluents~~ for analysis.

(6) Upon request by the Commissioner~~director of the Occupational Health Division~~, V~~ermont Y~~ankee N~~uclear P~~ower S~~tation management~~ shall furnish advance notification of each scheduled calibration of effluent monitors and will permit the Commissioner~~Director, or his authorized representative,~~ to be present during such calibration.

(7) Upon request by the Commissioner~~Director of the Occupational Health Division~~, V~~ermont Y~~ankee N~~uclear P~~ower S~~tation management~~ shall share samples of environmental media for purposes of data correlation.

Section 5-307. ~~Notice of violation in writing~~Enforcement.

~~If an inspection indicates that the source of radiation is not in compliance with radiation protection standards herein adopted, the operator or user shall be so notified in writing, with full particulars regarding any deficiencies.~~

(A) Whenever the Department has reasonable grounds to believe that there has been a violation of any of the provisions of this rule, the Department shall take appropriate action as provided in this subsection or otherwise provided in law, in order to protect the public health and safety.

(B) If an inspection, including the Department's independent compliance monitoring of VYNPS, indicates that the regulated entity is not in compliance with the requirements of this rule, the Department shall notify the regulated entity in writing, with full particulars regarding any deficiencies.

(1) The notice shall include specific required actions necessary for the regulated entity to take to regain compliance with this rule and may include interim actions, such as requiring further investigation of the circumstances giving rise to the notice, or ceasing use of the source of radiation until such time as full compliance is restored, or such other action deemed necessary by the Department to protect the public health and safety is completed.

(2) A regulated entity shall respond to the Department within the time specified in the notice, which shall be determined by the risk associated with the alleged non-compliance.

(3) If the regulated entity fails to timely and satisfactorily comply with the requirements of the notice, the Department may initiate an enforcement action.

(C) If the Department determines that an enforcement action is appropriate, or if timely and satisfactory compliance with a notice issued pursuant to subsection (B) of this subsection has not been achieved, the Department shall issue a notice of violation in writing. The notice shall specify the nature of the violation and required action to restore full compliance. If the Department determines that enforcement action is required, the Department may:

~~Section 5-308. Enforcement.~~

~~(A)Whenever there are reasonable grounds to believe that there has been a violation of any of the provisions of this regulation, the Board may~~

(1) refer the matter to the Attorney General for injunction proceedings consistent with 18 V.S.A. §1656, or

~~(2)issue an order after affording the alleged violator a hearing or~~

(2) in the event of an emergency, take immediate action consistent with 18 V.S.A. §1655 (b), or

~~(3) .~~initiate a proceeding before the Board by issuing a

~~In the event that the Board proceeds under 5-308 (A)(2) above, it shall give~~ written notice of the alleged violation to the regulated entity and filing the notice with the Board. The Board shall convene a contested case proceeding pursuant to 3 V.S.A. § 809 and 18 V.S.A. § 1655. ~~violator and shall afford him an opportunity for a hearing.~~ On the basis of the evidence produced at the hearing the Board shall make findings of fact and conclusions of law and enter such order as in its opinion will best further the purposes of this rule and applicable law ~~regulation~~ and shall give written notice of such order to the alleged violator, the Department and to ~~such~~ any other parties to the proceeding, or

(4) take such other action in the discretion of the Commissioner as authorized by law ~~other persons as shall have appeared at the hearing and made written request for notice of the order~~.

(D) An appeal of any order issued by the Board pursuant to this subsection shall be to the superior court as provided in 18 V.S.A. § 1655(c).

~~Section 5-309. Appeal.~~

~~Any person aggrieved by any decision, order, or decree of the State Board, issued pursuant to this regulation, may, within 30 days after receiving notice of such decision, order, or decree, appeal through the ordinary and usual process of law.~~

Section 5-30810. Registration.

(A) The owner or person having possession of any source of ionizing radiation except those exempted in Section 5-304, or licensed by the ~~U.S.~~ N~~uclear~~ R~~egulatory~~ C~~ommission~~, shall register each source with the ~~Occupational Health Division, Vermont State~~ Department ~~of Health, within 90 days following the effective date of this regulation and shall register each new source~~ within 30 days after the acquisition of such source. Registration shall be on forms provided by the Department ~~Division~~.

(B) The registrant shall notify the Department~~Division~~ within 30 days after any change in address or termination of use of any registered source of radiation.

(C) The owner or person having possession of any source of ionizing radiation not exempted in Section 5-304 (a) shall re-register such source every 3 years ~~upon notification by the Director of the Occupational Health Division~~.

(D) No person, in any advertisement, shall refer to the fact that a source is registered with the Department~~Division~~ and no person shall state or imply that any activity under such registration has been approved by the Department~~Division~~.

Section 5-30911. Transportation.

(A) Persons transporting or shipping radioactive materials into, out of, through, or within the state shall provide notification to the CommissionerDirector of Occupational Health prior to such shipment or transport if such shipment or transport meets any of the following criteria:

(1) Any shipment or package containing a large quantity of radioactive material as defined in Code of Federal Regulations, Title 49, Part 173, 389 (b), and Title 10, Part 71.4 (f).

(2) Fuel elements which have been utilized in a nuclear reactor.

(3) Any Fissile Class I, Class II, or Class III package as defined in Code of Federal Regulations, Title 49, Part 173.

(4) Any road, rail, air or sea transportcarload, boatload, planeload, or truckload lots of radioactive waste material for disposal.

(B) The shipper shall supply the following information in writing or by telephone to the CommissionerDirector of Occupational Health at least two working days prior to shipment. Schedule changes or additional information must be provided no later than two hours prior to shipment. To avoid undue hardship the CommissionerDirector may approve other reporting schedules requested by the shipper.

(1) Name of shipper.
(2) Name of carrier.
(3) Type and quantity of radioactive material.
(4) Date and time of shipment.
(5) Starting point, scheduled route, and destination.
(6) Other information required by the CommissionerDirector of Occupational Health.

(C) Shipments shall be made throughout the state with due regard to public health and safety. The CommissionerDirector of Occupational Health may require changes in dates, routes or time of shipment if necessary to maximize protection to public health and safety. Where possible, the CommissionerDirector shall coordinate such changes with his or her counterparts in adjoining political jurisdictions.

~~SUBCHAPTER 2. X-RAY SHOE FITTING~~

~~Section 5-321. Prohibition of X-ray Shoe Fitting Devices.~~

~~The Vermont State Board of Health hereby prohibits the installation or use of X-ray shoe fitting devices in the State of Vermont.~~

~~Source. Regulation on X-ray Shoe Fitting.~~
~~Authority. 18 V.S.A. Section 102~~
~~Effective Date: June 20, 1957~~
~~Preamble. This regulation contained the following preamble;~~

> ~~"WHEREAS, it has been made to appear to the Vermont State Board of Health and the Vermont State Board of Health does hereby find that there is evidence of radiation hazard to the public, particularly to children, from the use of X-ray shoe fitting devices, and~~
>
> ~~"WHEREAS, it has been made to appear to the Vermont State Board of Health and the Vermont State Board of Health does hereby find that the X-ray shoe fitting devices presently being used by retail shoe stores in the State of Vermont represent a radiation hazard to the public, particularly to children."~~

~~VERMONT DEPARTMENT OF HEALTH~~
~~DIVISION OF HEALTH PROTECTION~~
~~Radiological Health~~
~~PO Box 70~~
~~108 Cherry Street~~
~~Burlington, Vermont 05402-0070~~
~~Toll Free: 1-800-640-0601~~
~~Tel: 802-865-7730~~
~~Fax: 802-865-7745~~